

Appl. No. : 09/671,800
Filed : September 28, 2000

REMARKS

Claims 93 and 95-101 are currently pending in this application. Claims 1-92 are cancelled. Claim 93 is amended herein. Applicants respectfully request entry of the amendment as raising no new issues.

Rejections Under 35 U.S.C. §102

Claims 93, 95, 96, 100, and 101 are rejected under 35 U.S.C. §102(e) as being anticipated by Mayer et al., U.S. Patent No. 6,315,883. Claim 93 has been amended to recite “a planar conductive layer, as deposited, that is formed *within the cavity portion* and on the surface portion such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the thickness of the planar conductive layer within *the cavity portion*” (emphasis added). Applicants respectfully submit that the amendment made herein does not raise new issues, and require no new consideration and no new search.

Claim 93 also recites that “*the cavity portion* has at least a first cavity having a width of less than one micron and a second cavity having a width larger than 10 microns” (emphasis added). Thus, *the cavity portion* comprises both the first cavity (having a width of less than one micron) and the second cavity (having a width larger than 10 microns). Mayer does not teach or disclose a structure such as the one claimed in Claims 93.

The Mayer et al. equations referred to by the Examiner apply to cavities having *high aspect ratios* (i.e., cavities having a depth to width ratio greater than 3:1). See Mayer et al., at Col. 2, lines 25-33. Applicants respectfully submit that these equations cannot be used to arrive at the claimed invention because these equations cannot be applied to cavities having low aspect ratios, such as “the second cavity having a width larger than 10 microns,” as recited in Claim 93.

In the Final Office Action, the Examiner states “As written, applicant’s claim language is considered to encompass the geometry disclosed by Mayer et al. where the depth of filling (layer thickness) in cavities of different sizes may be different.” If that were the case, the layer would not be *planar* within the cavity portion (i.e., within both recited cavities) *and* on the surface portion, as there would be a big dip in the wide cavity.

Claim 93, as amended, recites that a planar conductive layer, as deposited, is “formed *within the cavity portion and on the surface portion* such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the

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thickness of the planar conductive layer within *the cavity portion*” (emphasis added). As noted above, the claimed “cavity portion” includes both a first cavity (having a width of less than one micron) and a second cavity (having a width of greater than 10 microns). Thus, the planar conductive layer, as recited in Claim 93, is formed within both the first cavity and the second cavity and on the surface portion.

Plating of conductive material in accordance with the Mayer et al. equations would not result in *a planar conductive layer, as deposited, formed within both the first and second cavities and on the surface portion* such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the thickness of the planar conductive layer within the first and second cavities, as recited in Claim 93. Application of the Mayer et al. equations would not result in a planar conductive layer formed in the second cavity (which is much wider than the first cavity) and on the surface portion such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the thickness of the planar conductive layer within the second cavity.

Applicants respectfully submit that application of the Mayer et al. equations to the claimed structure to fill both recited cavities would result in a thickness range of the conductive layer over the surface portion that is *not* within the claimed range of Claims 93 and furthermore would not be *planar*. Claim 93, as amended, is therefore patentable as it is not anticipated by Mayer et al. Claims 95, 96, 100, and 101, which depend from and include all of the limitations of Claim 93, as amended, are also patentable. Furthermore, each of the dependent claims recites further distinguishing features of particular utility.

Rejections Under 35 U.S.C. §103

Claims 93, 95, 96, 100, and 101 are rejected under 35 U.S.C. §103(a) as being unpatentable over Mayer et al. As discussed above, Claim 93 has been amended to recite “a planar conductive layer, as deposited, that is formed within the cavity portion and on the surface portion such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the thickness of the planar conductive layer within the cavity portion.”

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In the Office Action mailed January 20, 2004, the Examiner noted that “the choice of thickness of the conductive material with respect to the dimensions of the cavities would have been obvious to one of ordinary skill in the art because Mayer et al. [sic] typical values for cavity sizes and explain that the thickness of the deposited conductive layer should be sufficient to close the cleft above the cavities.”

Applicants respectfully disagree that it would have been obvious to choose the thickness of the conductive material with respect to the dimensions of the cavities. At Col. 2, lines 11-23, Mayer et al. describe the problem with filling low aspect ratio trenches: conformal metallization processes do not fill low aspect ratio trenches “because to do so would require depositing a very thick metal layer, which would be uneconomical to add and later remove.” Mayer et al., at Col. 2, lines 15-18. Mayer et al. discuss that conventional electropolishing can planarize a surface in which the feature to be planarized is no more than about three times as wide as it is deep and that for wider features, “electropolishing is very difficult, if not impossible.” *Id.*, at Col. 2, lines 18-23. Therefore, it would not have been obvious to simply choose the thickness of the conductive material based on the dimensions of the cavities.

Further, as discussed above, Mayer et al. noted that the equations described at Col. 2, lines 25-33, apply only to high aspect ratio trenches. Mayer et al. provided a method involving masking regions of the wafer surface during electropolishing in order to accomplish *planarization* of filled surfaces of a large range (a 1 μm deep feature having a range of widths from 0.2 μm to 100 μm) of feature sizes.

Applicants respectfully submit that Mayer et al. actually teach away from a *planar* conductive layer, as deposited, that is formed within the cavity portion and on the surface portion such that a predetermined thickness range of the planar conductive layer over the surface portion is between one tenth and one half of the thickness of the planar conductive layer within the cavity portion, as recited in Claim 93, as amended. Mayer et al. teach to electropolish in order to *planarize* filled surfaces of features *after* the conductive layer is deposited. Mayer et al. do not teach or suggest a *planar* conductive layer, *as deposited*, that is formed within the cavity portion and on the surface portion, as recited in Claim 93, as amended.

Therefore, Claim 93, as amended, is patentable as it is not obvious in view of Mayer et al. Claims 95, 96, 100, and 101, which depend from and include all of the limitations of Claim 93,

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as amended, are also patentable. Furthermore, each of the dependent claims recites further distinguishing features of particular utility.

Conclusion

Applicants respectfully submit that all of the pending claims are patentably distinguishable and allowable over the prior art of record. The cited references, either alone or in combination, do not teach or suggest the claimed invention.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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